



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>7</sup> : <b>H04N 1/60</b>	<b>A1</b>	(11) International Publication Number: <b>WO 00/44164</b> (43) International Publication Date: 27 July 2000 (27.07.00)
---	-----------	---

(21) International Application Number: PCT/US00/01548

(22) International Filing Date: 21 January 2000 (21.01.00)

(30) Priority Data:  
09/235,642 22 January 1999 (22.01.99) US(71) Applicant: ELECTRONICS FOR IMAGING, INC. [US/US];  
303 Velocity Way, Foster City, CA 94404 (US).(72) Inventor: MOTAMED, Margaret; 410 Nantucket Street, Foster  
City, CA 94404 (US).(74) Agents: GLENN, Michael, A. et al.; Glenn Patent Group, 125  
Lake Road, Portola Valley, CA 94028 (US).

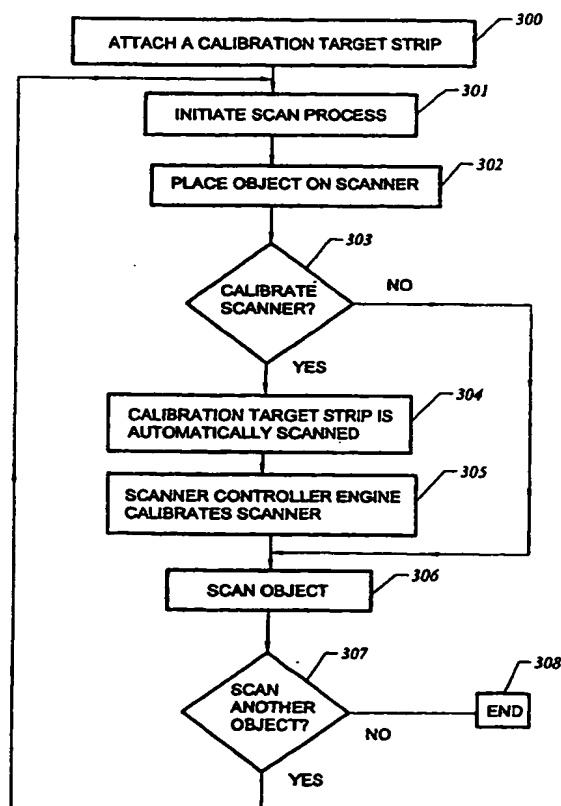
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

**Published***With international search report.**Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.*

(54) Title: AUTOMATIC SCANNER CALIBRATION

## (57) Abstract

An automatic scanner calibration method and apparatus is disclosed in which a calibrated target, such as a Kodak® gray strip, is attached to a scanning surface of a scanner. The target is thin and has a width or length of platen of a scanner. During a normal scan, the calibration target area can be ignored or scanned depending on user selection. If the strip is scanned, then the resulting information is used to calibrate the scanner automatically. Such calibration is more accurate than an older in time or preset default calibration. Another embodiment of the invention actuates a print of a printer calibration target on a printer on a scheduled basis. Thereafter, the user can take the printer calibration target and place it on the scanner and perform a calibration of a scanner/printer system.



**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

# AUTOMATIC SCANNER CALIBRATION

## BACKGROUND OF THE INVENTION

5

### FIELD OF THE INVENTION

The invention relates to the calibration of a scanner. More particularly, the invention relates to a method and apparatus for automatically calibrating a scanner. Another embodiment of the invention relates to calibrating a printer automatically.

10

### DESCRIPTION OF PRIOR ART

Many scanning and printing technologies are complex and, due to many different physical and environmental factors, may drift in their color response. For example, in the case of a scanner, the quality of light produced by the light source drifts over time due to the gradual variation of both electronic and optical components of the scanner. In the case of a printer, the amount of color toner or ink that is printed on paper changes over time. It is preferable that printers and scanners have a steady and consistent color response.

20 Prior art systems attempt to compensate for the difference in color behavior between a measured response of the printer or scanner and an ideal response of the printer or scanner by various calibrating techniques. One common way to calibrate a scanner involves scanning a calibrated target strip with a scanner and then using software that accompanies the calibrated target strip to perform the calibration. The software measures density values on the strip and compares the measured values to stored density values known to correspond to the calibrated target strip. The software generates modified or calibrated density values and typically stores the calibrated values in an association table known in the art as the lookup table (LUT). More expensive scanners are capable of running the software, while less expensive scanners run such software on an associated personal computer (PC).

30

Common in the art are two types of calibrated target strips that come with color management software and that can be purchased on the market. The two common strips are the Kodak® Gray Scale calibrated target strip produced by the Eastman Kodak Corp. of Rochester, N.Y. and the ANSI-standard IT8 target manufactured by, for example, the Agfa Division, Bayer

Corporation. The Kodak® Gray Scale comprises patches of varying densities of gray and the IT8 strips comprise color patches.

It is known to calibrate a color image reproduction system by generating a scanner calibration table and a printer calibration table. However, the method is elaborate in that it includes the steps of providing a set of calibration tools that are developed on a separate representative system and the steps of applying the calibration tools to calibrate the color image reproduction system. Refer to S. Wan and A. Leone, *Color Image Reproduction System Field Calibration Method and Apparatus*, U.S. Patent No. 5,452,112. (Sep.19, 1995).

L. Dietz, and T. Baer, *Calibration Method and Apparatus For Optical Scanner*, U.S. Patent No. 5,689,110. (Nov. 18, 1997), disclose a method and apparatus for calibrating a specialized optical scanner known as a fluorescence spectrometer. One of the apparent significant applications of a fluorescence scanner is in the field of medicine wherein, for example, a blood sample is mixed with a fluorescence dye, and the blood sample is scanned and analyzed to determine certain cell characteristics. The calibration method and apparatus disclosed in the document by L. Dietz and T. Baer involves such techniques as calibrating to calibration standards, such as gold and rubies, and is not directly relevant to the type of color image scanner addressed in this document.

D. Quardt and K. M. Chang, *Optical Scanner Threshold Setting Method and Sheet*, U.S. Patent 5,194,966 (Mar. 16, 1993), disclose a method for optimizing optical scanners by automatically determining image processing threshold values using a threshold image calibration sheet. One embodiment comprises the steps of repetitively scanning the sheet until scanner threshold values are determined. Another embodiment comprises the step of a single scan but uses two or more scanner cameras to work together to process the document images. The method disclosed in this document requires a significant amount of labor to complete repetitive scans and/or requires a scanning device having two or more cameras.

D. Sherman, Y. Accad, and E. Steinberg, *Method For Calibrating A Color Printer Using A Scanner For Color Measurements*, U.S. Patent No. 5,537,516. (Jul. 16, 1996) disclose a method for calibrating a subject scanner that uses a standard target with respect to a calibrated reference scanner, known as the object scanner. The method generates scanner correction tables for the readings of the subject scanner. The output of the object scanner when scanning a reference target is compared to the output of the subject scanner when

scanning the reference target. This method requires a deliberate action on the part of a user whenever calibration is desired in which the user is required to have the target on hand and the user is required to scan the target. Sherman et al. further provides an improved method of measuring ink densities using a subject scanner. In one embodiment, a target is placed at a defocused point with respect to a focal point of the scanning device, and in an alternate embodiment, a diffusing substrate rather than a defocusing means is placed between a target and the scanning device.

It is also known to generate a scanner profile by scanning a standard gray scale test strip comprising a plurality of gray scale patches and comparing the scanned test strip data to a stored data file containing density values known to correspond to the test strip. Refer to R. Falk, *Color Calibration Method And System Having Independent Color Scanner Profiles*, U.S. Patent No. 5,760,913, (Jun. 2, 1998). discloses the use of a scanner as a densitometer to calibrate a printer. As in some of the previously described documents, the method and system taught by Falk requires the user to have the standard gray scale test strip or its equivalent readily available and requires the user to scan a calibration target and a test strip on the scanner to perform the desired calibration process.

It would be advantageous to provide an automatic scanner calibration method and apparatus. For example, a user who must perform a calibration of a scanner may have misplaced a calibrated target strip. In the prior art, calibration cannot be performed if a target strip is misplaced.

It would also be advantageous for an automatic scanner calibration method and apparatus to provide a means by which a user can calibrate the scanner during a normal scan of an object. An automatic scanner calibration method and apparatus providing the means to calibrate the scanner during a normal scan of an object has the potential to be more accurate than older in time calibrations and more accurate than a scanner set to the preset default settings provided by the manufacturer. For example, it is well known in the art that a scanner can have a warm up time of about twenty minutes before reaching a steady output value. A user may desire to scan an image prior to a scanner reaching the steady output value. It would be advantageous for the user to calibrate the scanner automatically.

### SUMMARY OF THE INVENTION

The invention provides an automatic scanner calibration method and apparatus, including a calibration target strip that a user attaches once to any of an inside surface of a scanner glass, an outside surface of a scanner glass, or to an inside of a scanner cover. During a normal scan of an object, the user can select to ignore the calibration target strip or can select to scan the calibration target strip. If the calibration target strip is scanned, then the scanner is calibrated automatically during the scan of the object.

The presently preferred calibrated target strip is about one-quarter of an inch to one-half of an inch wide and generally has length that is approximately equal to the length or the width of the platen of the scanner. Standard manufactured calibration target strips can be purchased and used in the invention.

The strip also can be customized to suit a combination of needs. For example, the strip can comprise a decal that easily adheres to the scanner glass. The strip can adhere to the scanner in a variety of other ways. For example, the strip can slip into a plastic non-reflective sleeve, where the sleeve is attached to the inside of the scanner cover.

An alternate embodiment of the invention is provided that also comprises automatically calibrating a printer using a scanner. A print of a special printer calibration target is automatically actuated on the printer and a message is generated to ensure that the special printer calibration target is placed on the scanner. The special printer calibration target has interpretable data that represents the printer to be calibrated, the associated printer controller engine, and the date the target is printed. The interpretable data on the special printer calibration target can be embedded in a barcode using barcode technology.

To calibrate the printer the special printer calibration target is scanned on the scanner. During the scan the of special printer calibration target, the user can select also to calibrate the scanner. The calibration target strip attached to the scanner is scanned and the scanner is automatically calibrated before the automatic calibration of the printer without any additional effort by the user.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIGURE 1a is a block schematic diagram of the calibration system according to the invention;

5

FIGURE 1b is a block schematic diagram of the calibration system according to the invention;

10

FIGURE 2a is a top view of a calibrated target strip disposed on a scanner glass according to the invention;

FIGURE 2b is a top view of a calibrated target strip disposed on an inside cover of a scanner according to the invention;

15

FIGURE 3 is a reproduction of a calibration target strip;

FIGURE 4 is another reproduction of a calibration target strip;

20

FIGURE 5 is a flow diagram showing a method for automatically calibrating a scanner according to the invention;

FIGURE 6a is a block schematic diagram of an alternative calibration system according to the invention;

25

FIGURE 6b is a block schematic diagram of an alternative calibration system according to the invention;

FIGURE 7 is a flow diagram showing a method for automatically calibrating a printer and automatically calibrating a scanner according to the invention; and

30

FIGURE 8 is a pictorial illustration of a printer calibration target having a barcode according to the invention.

### DETAILED DESCRIPTION OF INVENTION

This invention provides an automatic scanner calibration method and apparatus which  
5 includes a calibration target strip that, in the presently preferred embodiment of the invention,  
a user attaches once to any of an inside surface of a scanner glass, an outside surface of a  
scanner glass, or an inside of a scanner cover. During a normal scan of an object, the user  
can select to ignore the calibration target strip or can select to scan the calibration target strip.  
If the calibration target strip is scanned, then the scanner is calibrated automatically during  
10 the scan of the object.

In the preferred embodiment of the invention, the calibrated target strip generally is about  
one-quarter of an inch to one-half of an inch wide and generally has length that is  
approximately equal to the length or the width of the platen of the scanner. Standard  
15 manufactured calibration target strips can be purchased and used in the invention.

The strip also can be customized to suit a combination of needs. For example, the strip can  
comprise a decal which easily adheres to the scanner glass. The strip can also be adhered to  
the scanner in a variety of other ways. For example, the strip can slip into a plastic non-  
20 reflective sleeve where the sleeve is attached to the inside of the scanner cover.

An alternate embodiment of the invention is provided that also comprises automatically  
calibrating a printer using a scanner. A print of a special printer calibration target is  
automatically actuated on the printer and a message is generated to ensure that the special  
25 printer calibration target is placed on the scanner. The special printer calibration target has  
interpretable data that represents the printer to be calibrated, the associated printer controller  
engine, and the date the target is printed. In one embodiment of the invention, the  
interpretable data on the special printer calibration target can be embedded in a barcode using  
barcode technology. To calibrate the printer the special printer calibration target is scanned  
30 on the scanner. During the scan the of special printer calibration target, the user can select  
also to calibrate the scanner. The calibration target strip attached to the scanner is scanned  
and the scanner is automatically calibrated before the automatic calibration of the printer  
without any additional effort by the user.



FIG. 1A shows a block diagram of an apparatus for practicing a presently preferred embodiment of the invention is shown. A client engine 10 is coupled to a scanner controller engine 20. The scanner controller engine 20 is coupled to the scanner 30. In one embodiment of the invention, the client engine 10 is a personal computer (PC) and the scanner controller engine 20 is software residing on the PC that controls a scanner 30 connected to the PC 10. In this embodiment, a user can scan an image on the scanner 30 by interacting with scanner software 20 on the PC 10.

Another block diagram of system for performing calibration in accordance with the invention is shown in FIG. 1b. A first client engine 50 is coupled to a scanner controller engine 60. A first scanner controller engine 60 is coupled to a second scanner controller engine 70 by a network connection 80. The second scanner controller engine 70 is coupled to a scanner 90. In an embodiment of the invention, the client engine 50 is a personal computer (PC), the first scanner controller engine 60 is software residing on the PC, the second scanner controller engine 70 is software residing on what is generally known to anyone in the art as a network, the first scanner controller engine 60 is coupled to the second scanner controller engine 70 by a typical network connection 80, and the second scanner controller engine 70 is coupled to a scanner 90 on the network. In this embodiment, a user can scan an image on the scanner 90 on the network by interacting with scanner software 60 on the PC 50.

The scanner software on the PC 60 comprises a user interface to the scanner controlling software 70 on the network. It will be apparent to a person skilled in the art that this embodiment of the invention particularly addresses what are currently expensive scanners that have embedded scanner controlling software and many varieties of scanners, including for example a copier that is self-contained, containing an interface to the user, as well as a scanner controller engine. The term scanner, as used herein, refers generally to a device for converting, for example, pictures, artwork, documents, transparencies, and photographs, into electronic form.

FIG. 2a is a top view of a calibrated target strip 200 disposed on a surface of a scanner glass 210 according to the invention. In one embodiment of the invention, the target strip 200 is made of decal paper. Other embodiments may include a target strip made of a material that adheres to said glass by static attraction or by "weak" adhesives, such as are used in Post-Its® manufactured by BM Corporation of Minneapolis, MN. The adherence mechanism should not possess optical qualities that distort the colors of the target strip. The strip 200 is

adhered to the glass 210. The strip 200 can remain on the glass 210 until a user decides to peel it off. The user does not have to worry about losing the strip and the strip is readily available when the user desires to calibrate the scanner.

- 5 Many variations on the properties of a calibrated target strip 200 are possible according to the invention. For example, the calibration target strip can be a photograph on photographic paper. The calibration target strip can be made of a dye sublimation print on photographic paper or on a paper equivalent to photographic paper. The calibration target strip can be made of a plastic material, wherein the plastic material has an adhering surface, and a  
10 covering over the surface, such that the adhering surface allows the plastic material to adhere to the top of the scanner glass, the bottom of the scanner glass, or the inside of the cover of the scanner when the covering is removed from the adhering surface. The plastic material can have a dye sublimation print printed on it. A user can apply a protective coating such as, for example, an ultra-violet resistant coating or a scratch resistant coating, to the calibration  
15 target strip prior to attaching the strip to the top of the scanner glass, the bottom of the scanner glass, or the inside of the cover of the scanner.

Manufactured calibration target strips can be purchased and used in the invention. Two examples of manufactured calibration target strips well known to a person skilled in the art  
20 are a Kodak Gray Strip by the Eastman Kodak Corporation of Rochester, N.Y. and the ANSI-standard IT8 target manufactured by, for example, the Agfa Division, Bayer Corporation (see FIGS 3 and 4). One embodiment of the invention uses a purchased calibration target strip in a scanner that has a tray device located at the scanner glass or located at the inside of the scanner cover, such that the calibrated target strip can be slipped into the tray so that it  
25 remains fixed until the user decides to remove the strip. The tray device according to the invention can hold a variety of types of targets in addition to manufactured targets. In another embodiment of the invention, the scanner has a plastic non-reflective sleeve located at the scanner glass or located at the inside of the scanner cover such that a calibrated target strip can be slipped in the plastic non-reflective sleeve.

30 Sometimes it is necessary for a user to use the entire scanning range of a scanner when scanning an object. Herein, the scanning range comprises a first surface area that spans a part of or all of the glass of the scanner and a second surface area that extends beyond the first surface area of the scanning range. Refer to FIG. 2b, which is a top view of a calibrated  
35 target strip 220 disposed on an inside cover 230 of a scanner 240 according to the invention.

In this embodiment of the invention, a calibrated target strip 220 is attached to the inside of the cover 230 of the scanner 240 in such a way that the calibrated target strip 220 is not fully overlapping any part of the first surface area of the scanning range but is overlapping a part of or all of the second surface area of the scanning range. An object covering the entire scanning glass and the calibrated target strip itself can both be scanned. In another embodiment of the invention, the calibrated target strip can be attached to the inside of the cover of the scanner.

In a preferred embodiment of the invention, the calibrated target strip has a width of approximately one-quarter of an inch or one-half of an inch and a length approximately equal to a length or a width of a platen of a scanner. These dimensions of the calibrated target strip ensure that the calibrated target strip occupies the least amount of the scanning range as possible so that as much of the scanning range as possible can be used for scanning objects.

FIG. 5 shows a flow diagram for automatically calibrating a scanner according to the invention. A calibrated target strip is attached to the inside surface of the scanner glass, the outside surface of the scanner glass, or the inside of the cover of the scanner (300). This step (300) is performed once. A user desires to scan an object on the scanner and initiates the scanning process (301). The user places the object on the scanner (302). By an interactive means with the scanner controller engine, the user decides whether the scanner is to be calibrated or not (303). If the user wants the scanner to be calibrated, the calibrated target strip is automatically scanned (304). Then the scanner controller engine performs the calibration on the scanner using the calibration target strip and generates calibrated values (305). The object is scanned using the updated calibrated values (306). If the user does not want the scanner to be calibrated, then steps (304) and (305) are ignored and the object is scanned using the current calibrated values (306). If the user has no more objects to scan (307), the process ends (308). Otherwise, the process is repeated (301). If the user desires, the user can calibrate the scanner for every single scan. The user can decide not to calibrate during a scan if it is more important to the user to perform the scan quickly rather than take the time to calibrate the scanner.

FIG. 6a shows a block diagram of an apparatus for automatically calibrating a scanner and for automatically calibrating a printer. A client engine 400 is connected to a printer 401 over a network connection 402 using a printer controller engine 403 that is coupled directly to the printer 401 and to the network connection 402. The client engine 400 is also connected to a

scanner 404 using a scanner controller engine 405 that is coupled directly to the client engine 400 and the scanner 404. In one embodiment of the invention, the client engine 400 is a personal computer (PC) and the scanner controller engine 405 is software residing on the PC that controls a scanner 404 that is connected to the PC 400. The PC 400 is connected over the network connection 402 to a printer 401 on the network. The printer controller engine 403 is implemented in software that resides on the network which controls the printer 401.

FIG. 6b shows a block diagram of an apparatus for automatically calibrating a scanner and for automatically calibrating a printer. A client engine 406 is connected to a printer 407 over a network connection 408 and the client engine 406 is connected to a scanner 409 over a network connection 408. The client engine 406 is coupled to the printer 407 and the scanner 409 using a multi-function scanner/printer controller engine 410 that is coupled to the network connection 408 and that is coupled directly to the printer 407 and to the scanner 409. The client engine 406 is a personal computer (PC) and the multi-function scanner/printer controller engine 410 is implemented in software which resides on the network that controls the printer 407 and the scanner 409.

FIG. 7 shows a flow diagram for automatically calibrating a printer and automatically calibrating a scanner. A client engine initiates a scheduled first message to a printer controller engine to print a printer calibration target (500). The schedule can be set according to the convenience of the user such as, for example the schedule can initiate a print each night. Upon completion of the print of the printer calibration target on the printer, the printer controller engine indicates by posting a second message to the client engine that the printer calibration target has been printed and further indicates by the same second message that the printer calibration target should be placed on the scanner (501). The printer controller engine waits for the client engine to respond that the printer calibration target is placed on the scanner (502). The step to scan the printer calibration target is initiated (503). In this embodiment of the invention, a calibration target strip is attached to the scanner and is scanned during the scanning of the printer calibration target. A multi-function scanner/printer controller engine calibrates the scanner and calibrates the printer by updating a lookup table (LUT) for the scanner and updating a LUT for the printer (504). The process illustrated in FIG. 5 provides a mechanism to ensure that the printer is calibrated on a regular basis without depending on a user to remember to calibrate the printer. A similar mechanism may be used to automatically calibrate the scanner in accordance with the embodiment of the invention discussed above.

In another embodiment of the invention, the print of the printer calibration target can be started simultaneously on multiple printers by one software/scanner combination. The operator may then place the printed calibration targets in any order either on the scanner glass or into the scanner's automatic document feeder.

FIG. 8 shows a pictorial illustration of an example of a printer calibration target having a barcode. The target has two columns 600 and 601 of the single ink colorants, cyan, magenta, yellow, and black. The left-hand column 600 has the single ink colorants in the order, cyan 602, magenta 603, yellow 604, and black 605 from left to right. The columns of single ink gradually decrease in density from full ink to no ink. The left-hand column 600 has density values decrease from the top part of the target to the bottom part of the target. The right hand column 601 is organized similarly with some items in the reverse order. The right hand column 601 has the single ink colorants in the order, black 606, yellow 607, magenta 608, and cyan 609 from left to right. The columns of single ink gradually increase in density from no ink to full ink. The right hand column 601 has density values increase from the top part of the target to the bottom part of the target. In the preferred embodiment of the invention, a barcode 610 is printed on the target, the barcode contains data that identify the printer on which the target was printed, the printer controller engine associated with the printer on which the target was printed, and the date the target was printed. Those skilled in the art will appreciate that other information may be printed on the target and that the indicator by which the information is recognized is not limited to bar codes (although a bar code-like mechanism stores information in format that is readily recognized when scanned by the scanner).

Although the invention is described herein with reference to the preferred embodiment, one skilled in the art will readily appreciate that other applications may be substituted for those set forth herein without departing from the spirit and scope of the present invention. Accordingly, the invention should only be limited by the Claims included below.

CLAIMS

1. A method for automatically calibrating a scanner, comprising the steps of:  
affixing a calibration target to a scanning surface of said scanner; and  
5 using said calibration target for automatically calibrating said scanner during scanning  
an object when automatic scanning of said calibration target is selected.
2. A method as in Claim 1, wherein said scanner comprises a platen; and  
wherein said calibration target comprises a width of approximately or equal to a  
10 length of or a width of said platen.
3. A method as in Claim 1, wherein said calibration target is a Kodak® Gray Strip, an  
IT8™ target, or an equivalent manufactured calibration target.
- 15 4. A method as in Claim 1, wherein the calibration target comprises a photograph on  
photographic paper.
5. A method as in Claim 1, wherein the calibration target strip comprises a dye  
sublimation print on photographic paper or paper equivalent to photographic.  
20
6. A method as in Claim 1, wherein the calibration target comprises:  
a plastic material, said plastic material having an adhering surface and a covering over  
said adhering surface such that the adhering surface allows the plastic material to adhere to a  
part of the scanner when the covering is removed from the adhering surface.  
25
7. A method as in Claim 1, wherein the calibration target comprises:  
a dye sublimation print onto a plastic material, said plastic material having an  
adhering surface and a covering over said adhering surface such that said adhering surface  
allows said dye sublimated plastic material to adhere to a part of said scanner when said  
30 covering is removed from said adhering surface.
8. A method as in Claim 1, further comprising the step of :  
providing a calibration target having a protective coating.
- 35 9. A method as in Claim 1, wherein the calibration target comprises decal paper.

10. A method as in Claim 1, wherein the scanner has a scanning range that comprises a first surface area that spans a part of or all of the glass of the scanner and a second surface area that extends beyond the first surface area of the scanning range; and

5 the step of attaching said calibration target further comprises;  
attaching said calibration target to a cover of said scanner in such a way that said calibration target is not fully covering any part of the first surface area of the scanning range but is covering a part of the second surface area of said scanning range, wherein said calibration target is within said scanning range of said scanner.

10 11. A method as in Claim 1, wherein the scanner further comprises a tray device located proximate to a scanning surface for holding said calibrated target fixedly therein.

12. A method as in Claim 1, wherein the scanner further comprises a plastic non-  
15 reflective sleeve located proximate to a scanning surface for fixedly holding said calibration target in said sleeve.

13. An apparatus for automatically calibrating a scanner, comprising:  
a calibration target;

20 means for attaching said calibration target proximate to a scanning surface of said scanner; and

means for automatically calibrating said scanner with said calibration target during scanning of said object when said calibration target is scanned.

25 14. An apparatus as in Claim 13, wherein the scanner further comprises;  
a platen; and

wherein said calibration target comprises a width approximately equal to a length of or a width of said platen.

30 15. An apparatus as in Claim 13, wherein the calibration target is a Kodak® Gray Strip, an IT8™ target, or an equivalent manufactured calibration target.

16. An apparatus as in Claim 13, wherein calibration target comprises a photograph on photographic paper.

17. An apparatus as in Claim 13, wherein the calibration target comprises a dye sublimation print on photographic paper or paper equivalent to photographic paper.

18. An apparatus as in Claim 13, wherein the calibration target strip comprises a plastic material, said plastic material having an adhering surface and a covering over said adhering surface such that said adhering surface allows said plastic material adhere to said scanner when said covering is removed from said adhering surface.

19. An apparatus as in Claim 13, wherein the calibration target comprises a dye sublimation print onto a plastic material, said plastic material having an adhering surface and a covering over said adhering surface such that said adhering surface allows said dye sublimated plastic material to adhere to a part of said scanner when said covering is removed from said adhering surface.

20. A calibration target strip in Claim 13, wherein said calibration target has a protective coating.

21. A calibration target strip in Claim 1, wherein said calibration target comprises decal paper.

22. An apparatus as in Claim 13, wherein the scanner has a scanning range that comprises a first surface area that spans a part of or all of said scanning surface of the scanner and a second surface area that extends beyond the first surface area of said scanning range; and

wherein said calibration target is attached to the cover of said scanner in such a way that said calibrated target is not fully covering any part of the first surface area of the scanning range but is covering a part of the second surface area of the scanning range, wherein the calibrated target is within said scanning range of said scanner.

23. An apparatus as in Claim 13, wherein said scanner has a tray fixedly located proximate to said scanning surface for holding calibrated target in said tray.

24. An apparatus as in Claim 13, wherein said scanner has a plastic non-reflective sleeve located proximate to said scanning surface for holding said calibrated target thereto.



25. A method for automatically printing a printer calibration target on a printer and automatically calibrating said printer using a scanner, comprising the steps of:

actuating automatically a print of the printer calibration target on said printer;

placing said printer calibration target on said scanner;

5 scanning said printer calibration target on said scanner; and

performing a calibration of said printer using said scanned printer calibration target.

26. The method of Claim 25, wherein a client engine and a printer controller engine are employed and wherein the method further comprises the steps of:

10 generating a scheduled first message from the client engine to the printer controller engine, said scheduled first message automatically actuating the print of the printer calibration target on said printer;

generating a second message from the printer controller engine to the client engine after the print of the printer calibration target, said second message indicating that the printer calibration target has been printed and indicating that the printer calibration target needs to be placed on said scanner; and

15 waiting for the client engine to respond to the printer controller engine that the printer calibration target has been printed on said printer and has been placed on said scanner.

20 27. The method of Claim 26, wherein the printer calibration target has interpretable data, said data identifying said printer and said printer controller engine, and the date that the printer calibration target was printed, and wherein the step of performing a calibration of said printer using said scanned printer calibration target further comprises the client engine interpreting said data to identify said printer to be calibrated and to identify said printer controller engine.

28. The method of Claim 27, wherein said interpretable data is included in a printed barcode and wherein the step of scanning said printer calibration target on said scanner comprises scanning said barcode.

30 29. The method of Claim 25, wherein a calibration target strip is attached to said scanner and wherein the step of scanning said printer calibration target on said scanner further comprises the step of automatically scanning the calibration target strip and automatically calibrating said scanner.

35

30. The method of Claim 29 wherein the step of automatically calibrating said scanner further comprises a scanner controller engine or a multi-function scanner/printer controller engine and further comprises the steps of:

- 5 selecting to ignore said calibration target strip or selecting to scan said calibration target strip; and  
calibrating automatically said scanner during scanning of said printer calibration target when said calibration target strip is selectably scanned.

31. An apparatus for automatically printing a printer calibration target on a printer and automatically calibrating said printer using a scanner, comprising:

- 10 a printer calibration target;  
a printer;  
means for automatically actuating said printer calibration target to print on said printer;  
15 a scanner;  
means for placing said printer calibration target on said scanner;  
means for scanning said printer calibration target on said scanner;  
a lookup table (LUT) for the printer, such LUT mapping a plurality of absolute density values to a corresponding plurality of calibrated density values;  
20 means for updating said LUT for the printer after the printer calibration target is scanned and by using the printer calibration target, thereby calibrating said printer.

32. An apparatus as in Claim 31, further comprising:

- 25 a client engine and a printer controller engine, and wherein means for automatically actuating said printer calibration target to print on said printer further comprises means for generating a scheduled first message from the client engine to the printer controller engine;  
means for generating a second message from the printer controller engine to the client engine after the print of the printer calibration target, said second message indicating that the printer calibration target has been printed and indicating that the printer calibration target  
30 needs to be placed on said scanner; and  
means for waiting for the client engine to respond to the printer controller engine that the printer calibration target has been placed on said printer and has been placed on said scanner.

33. The apparatus of Claim 32, wherein the printer calibration target has interpretable data, said data representing information that identifies the printer, the printer controller engine, and the date that the printer calibration target was printed on the printer, and further comprising means for the client engine to interpret said data.

5

34. The apparatus of Claim 33, wherein said interpretable data is included in a printed barcode and further comprising means for scanning said barcode.

35. The apparatus of Claim 33 further comprising:

10

a calibrated target strip fixedly attached to said scanner;

means for automatically scanning said calibrated target strip;

a lookup table (LUT) for said scanner, said LUT mapping a plurality of input scanner signals to a plurality of corresponding calibrated density values; and

means for updating the LUT for the scanner by using the scanned calibrated target

15

strip, thereby calibrating said scanner.

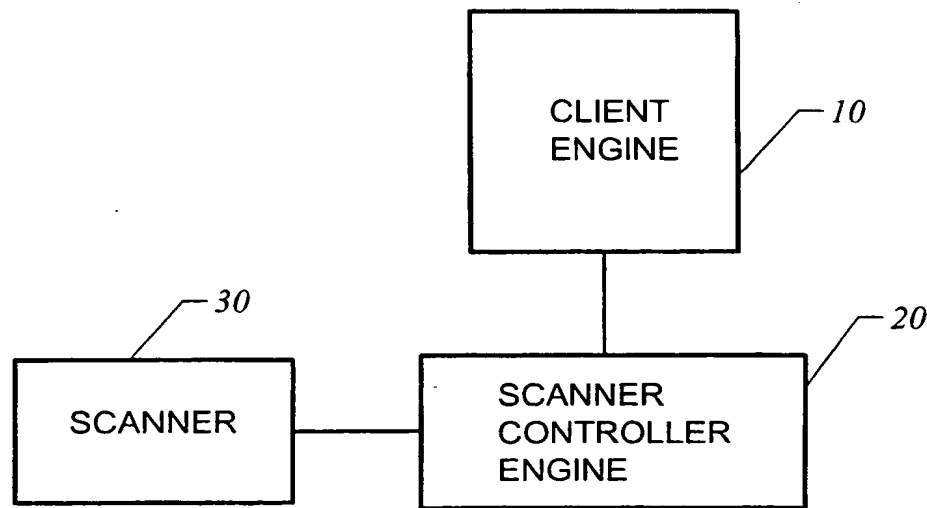
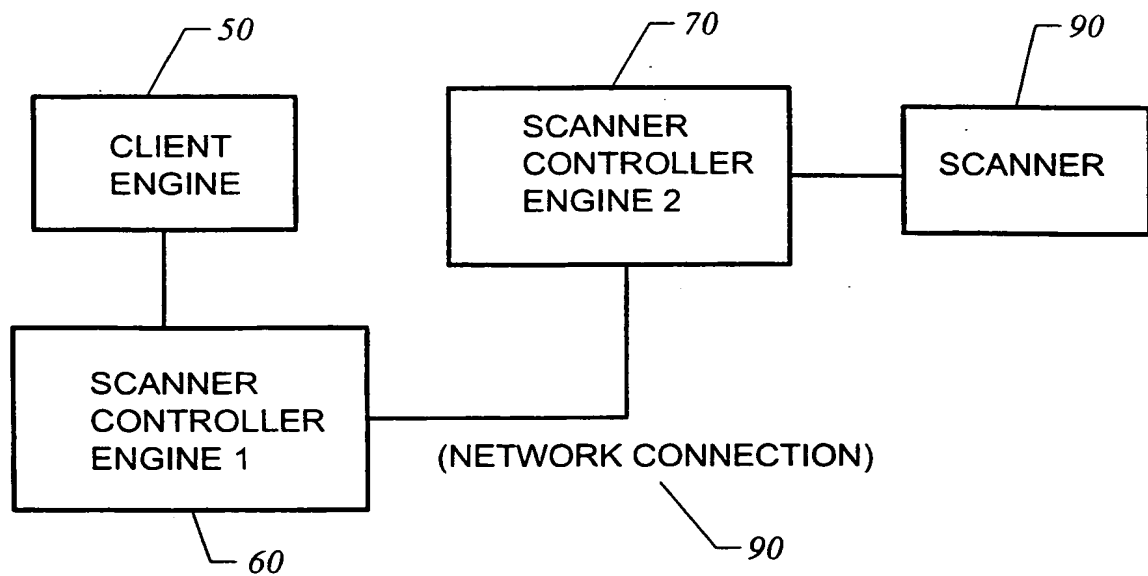
36. The apparatus of Claim 35, wherein means for automatically calibrating said scanner further comprises:

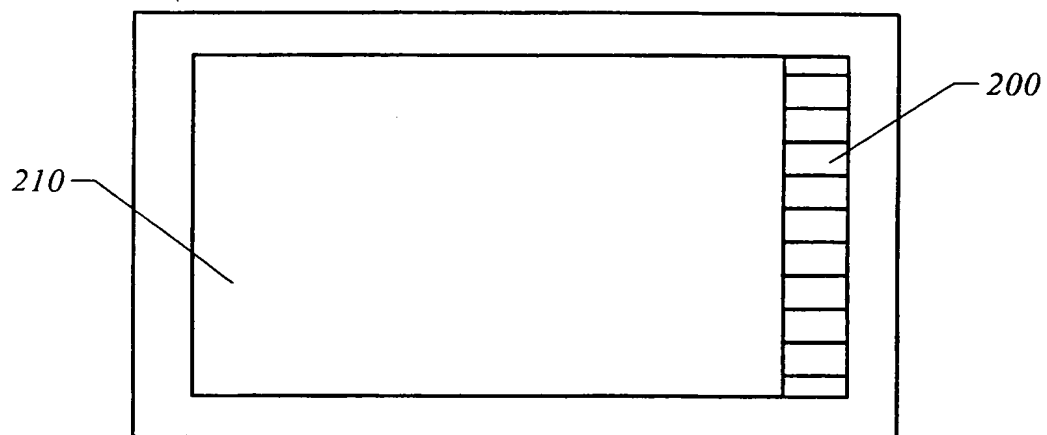
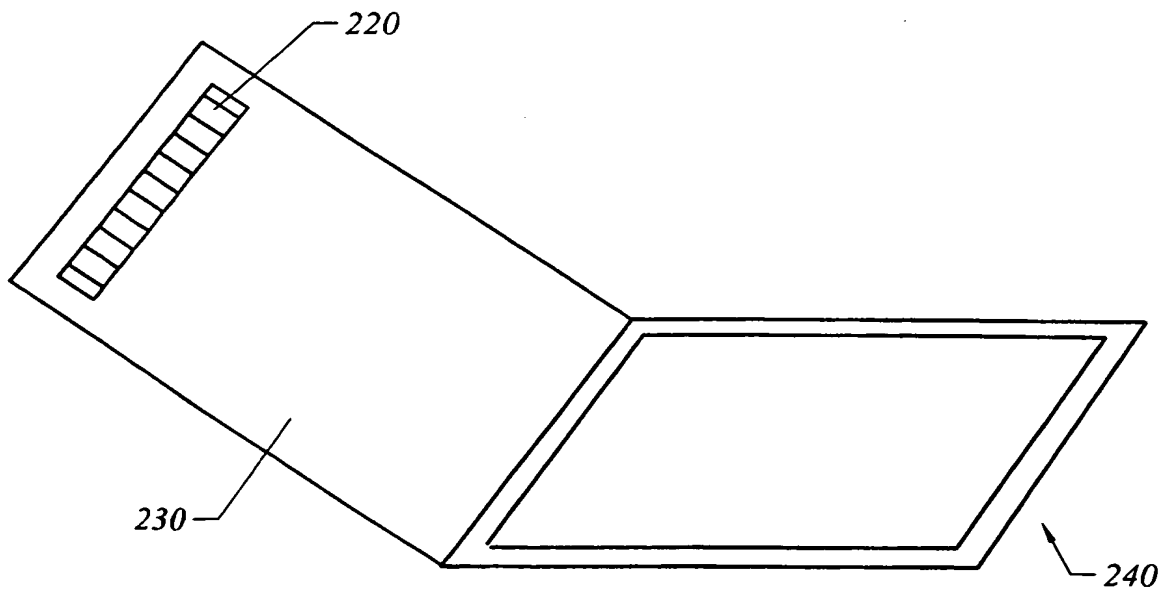
means for selecting to ignore said calibration target strip or selecting to scan said

20

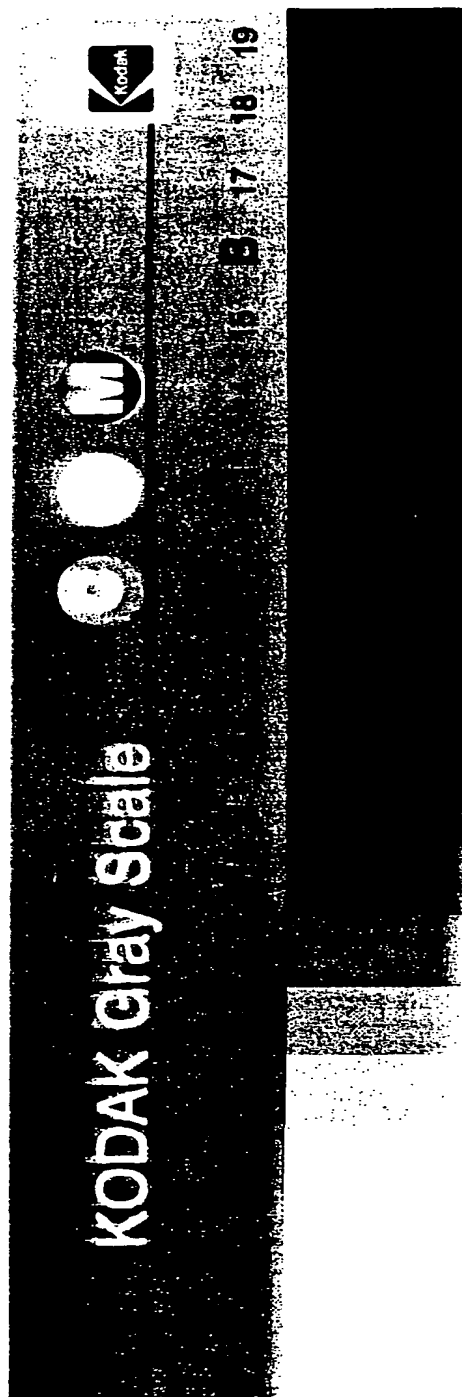
calibration target strip; and

means for automatically calibrating the scanner during scanning of the printer calibration target when the calibration target strip is selectably scanned.

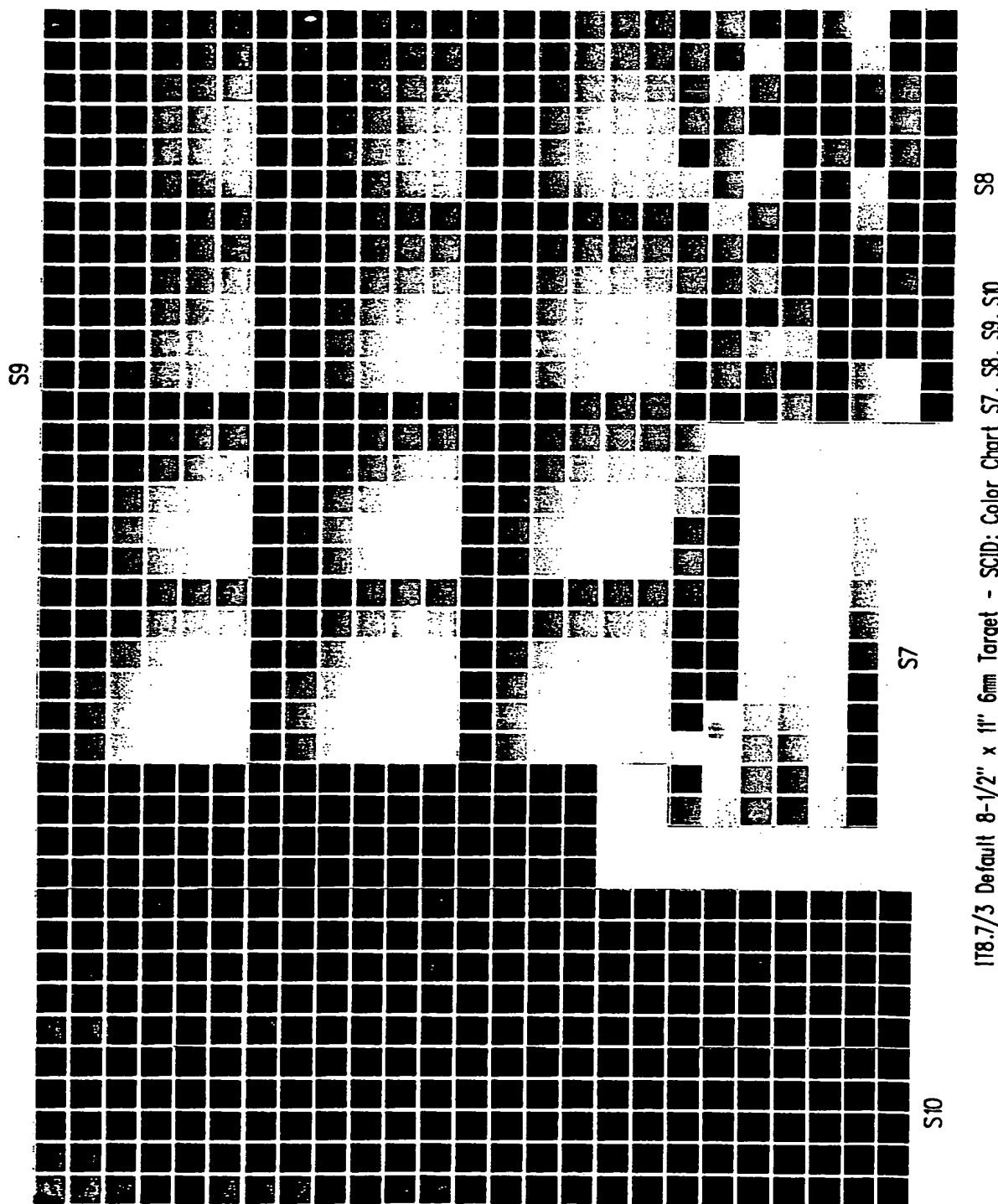
*FIG. 1A**FIG. 1B*

*FIG. 2A**FIG. 2B*

3/8



*FIG. 3*  
(PRIORART)



178.7/3 Default 8-1/2" x 11" 6mm Target - SCID: Color Chart S7, S8, S9, S10

FIG. 4 (PRIORART)

5/8

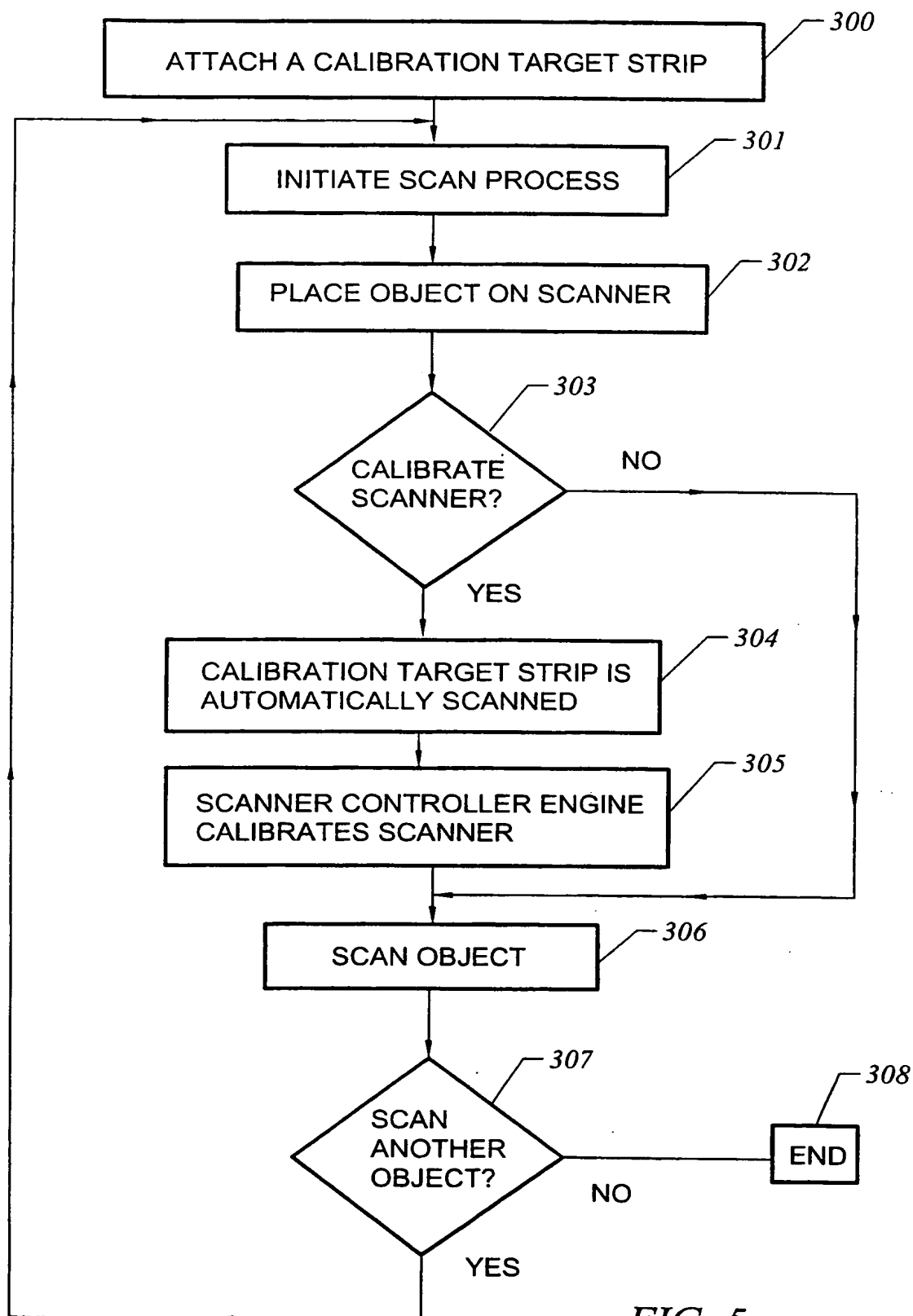


FIG. 5



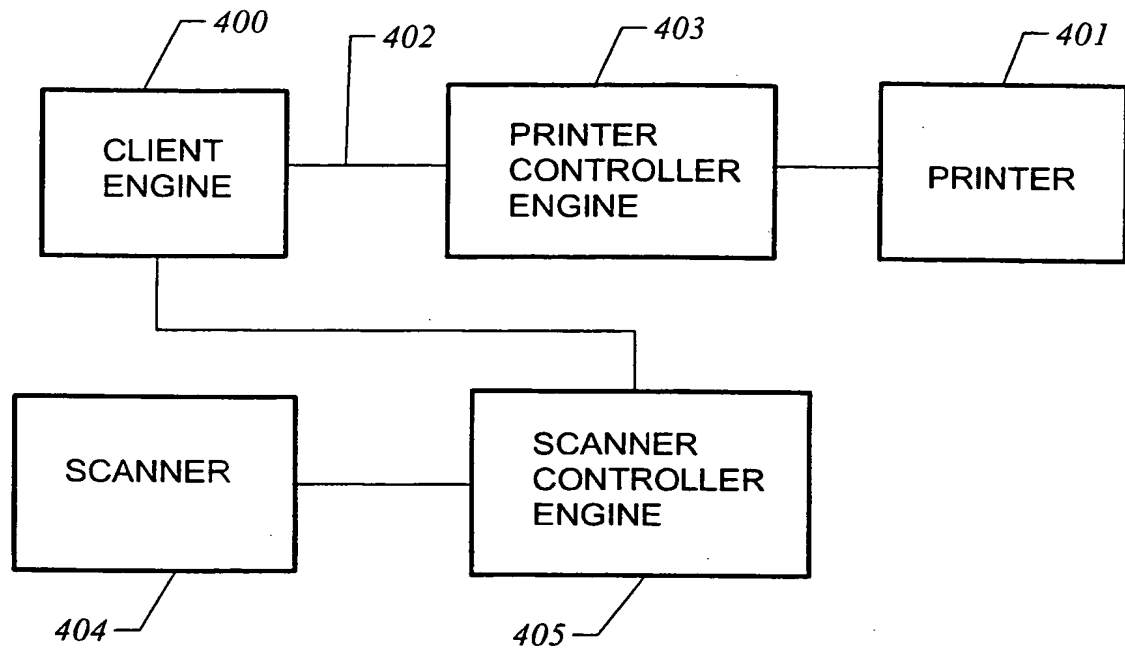


FIG. 6A

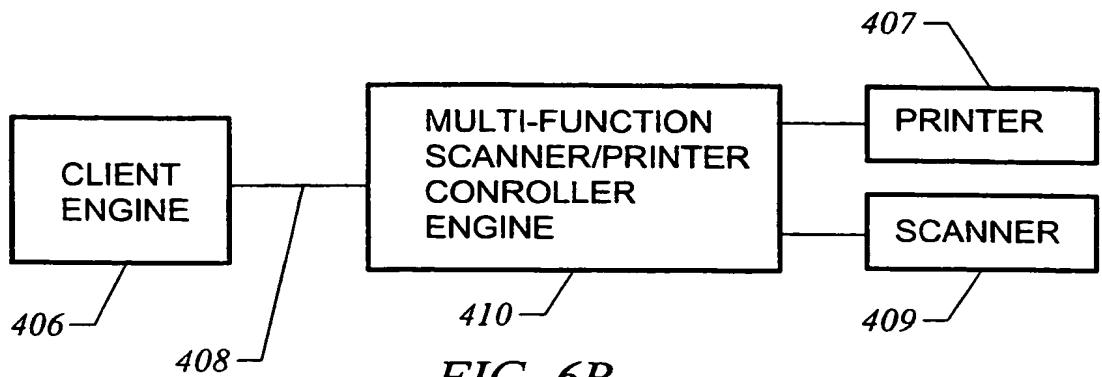


FIG. 6B

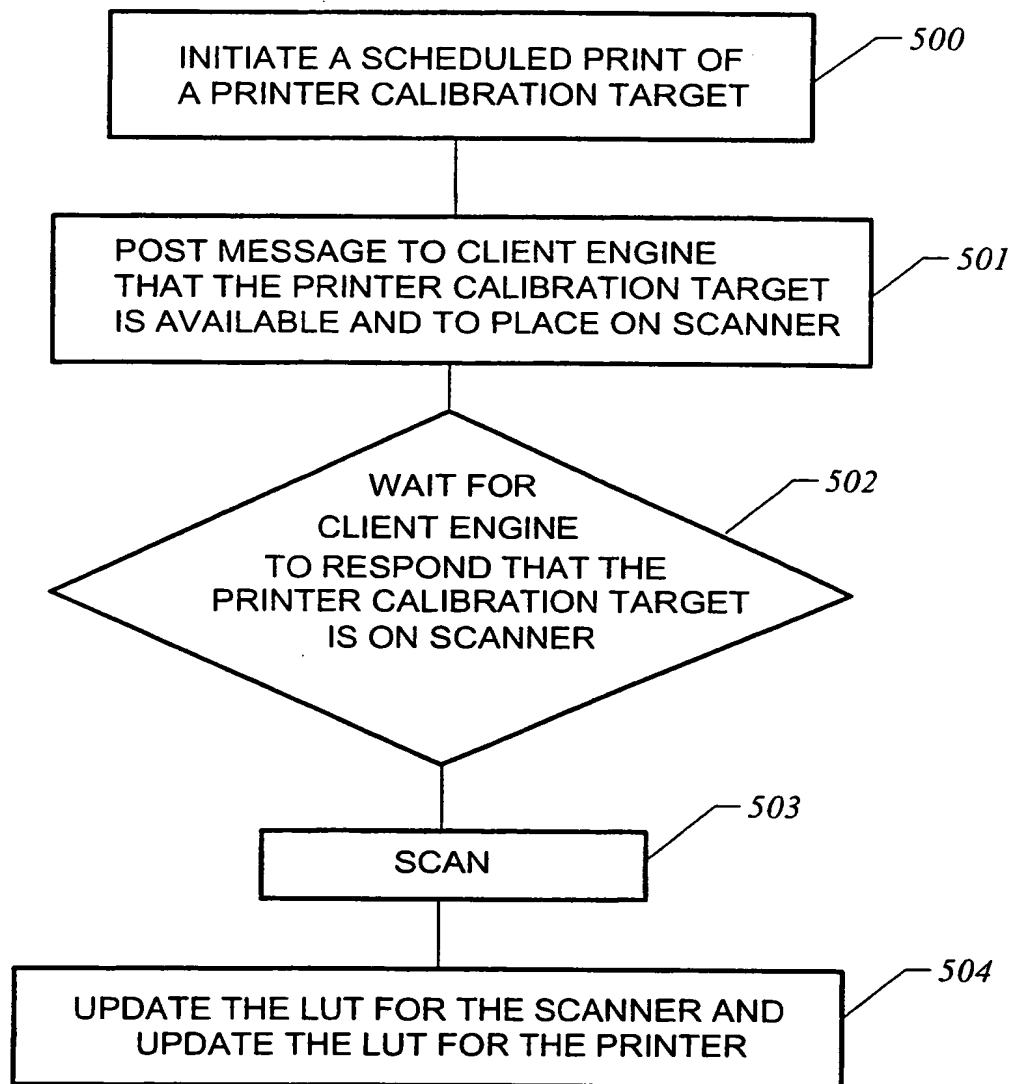


FIG. 7

8/8

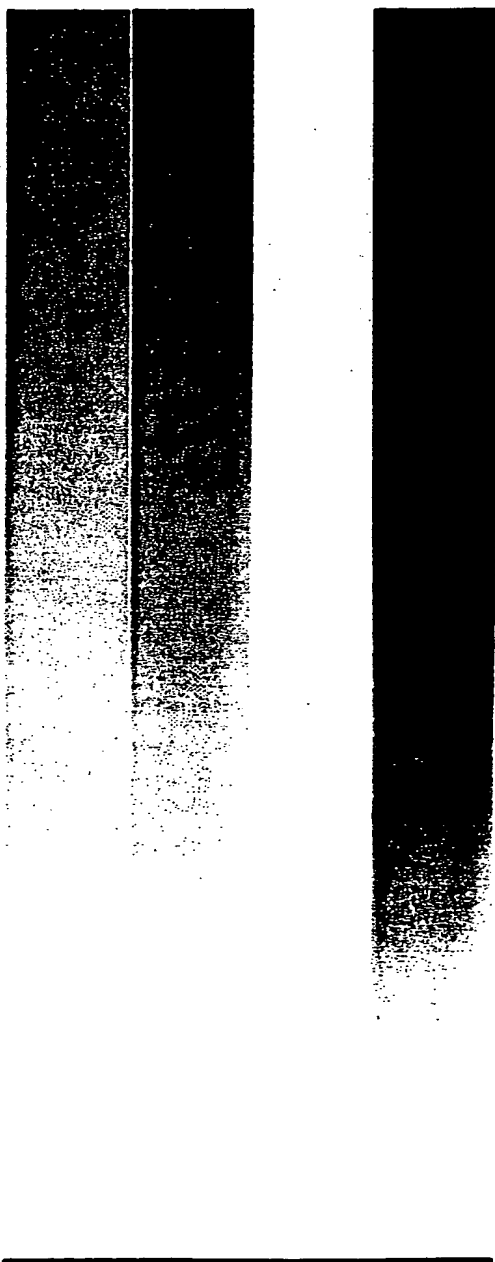
7-22868-13137-4

610



600

602 603 604 605



601

606 607 608 609

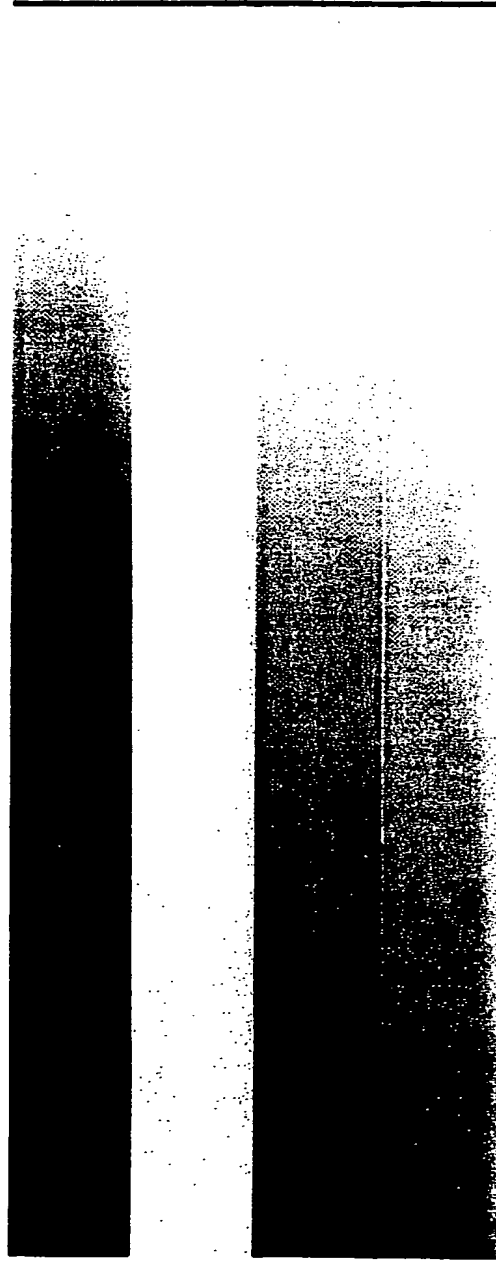


FIG. 8

# INTERNATIONAL SEARCH REPORT

Internat Application No

PCT/US 00/01548

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H04N1/60

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 301 506 A (DAINIPPON SCREEN MFG. CO.) 1 February 1989 (1989-02-01) column 2, line 5 - line 19 column 4, line 37 - line 55	1-4, 13, 15, 16
A	US 5 282 053 A (R. P. ROBIDEAU) 25 January 1994 (1994-01-25)	
A	US 5 589 951 A (H. WOYDICH) 31 December 1996 (1996-12-31)	
Y	GB 2 308 773 A (RICOH COMPANY LTD.) 2 July 1997 (1997-07-02) page 15, line 6 -page 17, line 23	1-4, 13, 15, 16
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

11 May 2000

Date of mailing of the international search report

18/05/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

De Roeck, A

# INTERNATIONAL SEARCH REPORT

Internat	Application No
PCT/US	00/01548

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 760 913 A (R. A. FALK) 2 June 1998 (1998-06-02) cited in the application	25,31
Y A	column 5, line 64 -column 6, line 4 column 7, line 8 - line 24 figure 4	3,15 35
Y	EP 0 562 971 A (EASTMAN KODAK COMPANY) 29 September 1993 (1993-09-29) page 6, line 28 - line 52	4,16
X	WO 92 01264 A (LIGHT SOURCE COMPUTER IMAGES) 23 January 1992 (1992-01-23) page 5, line 31 -page 6, line 26	25
X	US 5 452 112 A (SHIJIE WAN) 19 September 1995 (1995-09-19) cited in the application	31
A	column 3, line 45 -column 5, line 44	35

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Internati- Application No

PCT/US 00/01548

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 301506	A	01-02-1989	JP 1036168 A	07-02-1989
			JP 1889932 C	07-12-1994
			JP 6020222 B	16-03-1994
			DE 3888744 D	05-05-1994
			DE 3888744 T	20-10-1994
			US 4996605 A	26-02-1991
US 5282053	A	25-01-1994	CA 2077326 A,C	24-04-1993
			JP 5227426 A	03-09-1993
US 5589951	A	31-12-1996	DE 4122205 A	14-01-1993
			DE 4135626 A	06-05-1993
			CA 2112739 A	21-01-1993
			DE 9117230 U	04-09-1997
			WO 9301678 A	21-01-1993
			EP 0592501 A	20-04-1994
GB 2308773	A	02-07-1997	JP 9186891 A	15-07-1997
			JP 9186899 A	15-07-1997
			JP 9186900 A	15-07-1997
			DE 19654755 A	03-07-1997
			GB 2318014 A,B	08-04-1998
			US 5978506 A	02-11-1999
US 5760913	A	02-06-1998	NONE	
EP 562971	A	29-09-1993	US 5363318 A	08-11-1994
			JP 7288698 A	31-10-1995
WO 9201264	A	23-01-1992	AU 8327991 A	04-02-1992
			US 5271096 A	14-12-1993
US 5452112	A	19-09-1995	EP 0674429 A	27-09-1995
			JP 8046750 A	16-02-1996